Successes of gauge theories

1) **electro-weak** (arbitrary weinberg angle fixes ratio Z/W mass)

a) electron-proton elastic scattering asymmetry, parity violating effects with polarized electrons due to weak neutral current as function of energy — SLAC 1978 — Prescott and Taylor.

b) optical rotation in atoms like bismuth and hydrogen.

c) prediction of charm due to non-existence of strangeness-changing decays like $K^- \to \mu^+ \mu^-$ etc.

d) ν scattering off protons $\nu + p \to \nu + p$.

f) ν-electron scattering

2) **QCD** 1) $R = \frac{e^+e^- \to \text{hadrons}}{e^+e^- \to \text{muons}}$ as function of energy

2) Deep inelastic e-p scattering detailed cross-section, energy dependence, etc.

3) Jet phenomena. 2-jet / 3-jet in $e^+e^- \to$ hadrons

3) **GUT** — Proton decay

MB

localization of the photon → Compton wavelength

$$\frac{\hbar}{mc} \times \sqrt{1-\beta^2}$$

$$= \frac{\hbar c}{E}$$

For photon $E = h\nu$

So localization $\approx \frac{c}{\nu} = \lambda$.